

**WHAT IS CLAIMED IS:**

1. An oligomeric para-phenylene compound having the formula:



wherein

the subscript n is an integer of from 5 to 15;

the superscript  $i$  is an integer of from 1 to  $n$  and denotes the position downstream from

 $\mathbb{R}^1;$ 

each Ar is a substituted or unsubstituted aryl group;

R<sup>1</sup> and R<sup>2</sup> are each substituents that increase the solubility of the para-phenylene

compound in nonpolar organic solvents relative to the solubility of the

corresponding compound wherein R<sup>1</sup> and R<sup>2</sup> are hydrogen;

with the proviso that the Ar<sup>1</sup> groups are linked together in a 1,4-paraphenylene

manner.

2. A compound of claim 1, wherein n is an integer of from 5 to 9.

**3.** A compound of claim 1, wherein said Ar<sup>i</sup> groups are independently unsubstituted phenylene and phenylene having from 1 to 4 fluoro substituents.

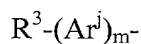
4. A compound of claim 1, wherein said Ar<sup>1</sup> groups are independently unsubstituted phenylene, phenylene having from 1 to 4 fluoro substituents; and unsubstituted fused polycyclic aryl with the proviso that any fused polycyclic are linked in the compound in a manner that maintains a coplanar orientation of adjacent Ar<sup>1</sup> groups.

5. A compound of claim 4, wherein said fused polycyclic aryl groups are the group consisting of 2,6-naphthylene, 2,7-phenanthrylene, 2,6-anthrylene, and fluorenylidene.

6. A compound of claim 1, wherein the subscript n is 7 and Ar<sup>3</sup> and Ar<sup>5</sup> are unsubstituted 2,6-naphthylene.

7. A compound of claim 1, wherein the subscript n is 7 and Ar<sup>4</sup> bears two unsubstituted phenyl ring substituents other than the remaining Ar<sup>1</sup> groups.

1                   8.       A compound of claim 1, wherein R<sup>1</sup> and R<sup>2</sup> are each independently  
2 substituents having the formula:

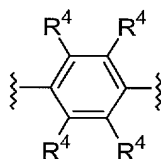


4 wherein

5 the subscript m is an integer of from 1 to 5;

6 each Ar<sup>j</sup> is selected from the group consisting of

7 a) a 1,4-phenylene group having the formula:



9 wherein each R<sup>4</sup> is a member independently selected from the group consisting of

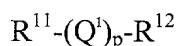
10 H, substituted or unsubstituted (C<sub>1</sub>-C<sub>12</sub>)alkyl, substituted or unsubstituted (C<sub>1</sub>-  
11 C<sub>12</sub>)alkoxy, substituted or unsubstituted (C<sub>1</sub>-C<sub>12</sub>)alkylamino, substituted or  
12 unsubstituted (C<sub>1</sub>-C<sub>12</sub>)alkylthio, substituted or unsubstituted di(C<sub>1</sub>-  
13 C<sub>12</sub>)alkylamino, substituted or unsubstituted arylamino, substituted or  
14 unsubstituted diarylamino and halogen, with the proviso that at least two of  
15 the four R<sup>4</sup> substituents are independently selected from substituted or  
16 unsubstituted (C<sub>1</sub>-C<sub>12</sub>)alkyl and substituted or unsubstituted (C<sub>1</sub>-C<sub>12</sub>)alkoxy,  
17 and

18 b) an aryl biradical selected from the group consisting of 1,4-naphthylene, 1,4-  
19 anthrylene, 9,10-anthrylene, 5,6,7,8-tetrahydronaphth-1,4-ylene, 9,9',10,10'-  
20 tetra(C<sub>1</sub>-C<sub>12</sub>)alkyl-9,10-dihydroanthr-1,4-ylene, 9,9'10,10'-tetraaryl-9,10-  
21 dihydroanthr-1,4-ylene, 9,9'10,10'-tetra(C<sub>1</sub>-C<sub>12</sub>)alkyl-9,10-dihydroanthr-2,6-  
22 ylene, 9,9'10,10'-tetraaryl-9,10-dihydroanthr-1,4-ylene; and

23 R<sup>3</sup> is selected from the group consisting of H, substituted or unsubstituted (C<sub>1</sub>-  
24 C<sub>12</sub>)alkyl, substituted or unsubstituted (C<sub>1</sub>-C<sub>12</sub>)alkoxy, substituted or  
25 unsubstituted (C<sub>1</sub>-C<sub>12</sub>)alkylamino, substituted or unsubstituted (C<sub>1</sub>-  
26 C<sub>12</sub>)alkylthio, substituted or unsubstituted di(C<sub>1</sub>-C<sub>12</sub>)alkylamino, substituted or  
27 unsubstituted arylamino, substituted or unsubstituted diarylamino and halogen.

1                   9.       A compound of claim 8, wherein m is an integer of from 1 to 3.

1                   10.      A polymer of the formula:



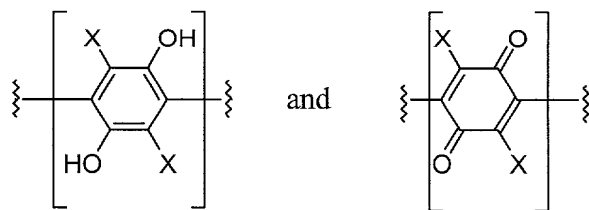
wherein

each  $R^{11}$  and  $R^{12}$  is independently selected from the group consisting of H, substituted or unsubstituted  $(C_1-C_{12})$ alkyl, substituted or unsubstituted  $(C_1-C_{12})$ alkoxy, substituted or unsubstituted  $(C_1-C_{12})$ alkylamino, substituted or unsubstituted  $(C_1-C_{12})$ alkylthio, substituted or unsubstituted di $(C_1-C_{12})$ alkylamino, substituted or unsubstituted arylamino, substituted or unsubstituted diarylamino and halogen;

the subscript p is an integer of from 5 to 200;

the superscript i is an integer of from 1 to p and indicates the position downstream from  $R^1$  of each Q;

each  $Q^i$  is a benzoquinone or hydroquinone subunit selected from the formulae:



wherein

each X is independently selected from the group consisting of H, substituted or unsubstituted  $(C_1-C_{12})$ alkyl, substituted or unsubstituted  $(C_1-C_{12})$ alkoxy, substituted or unsubstituted  $(C_1-C_{12})$ alkylamino, substituted or unsubstituted  $(C_1-C_{12})$ alkylthio, substituted or unsubstituted di $(C_1-C_{12})$ alkylamino, substituted or unsubstituted arylamino, substituted or unsubstituted diarylamino and halogen.

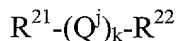
**11.** A polymer of claim 10, wherein said hydroquinone and benzoquinone subunits are present in about a 50:50 ratio.

**12.** A polymer of claim 10, wherein said hydroquinone and benzoquinone subunits alternate in said polymer so that no two hydroquinone subunits are adjacent and no two benzoquinone subunits are adjacent.

**13.** A polymer of claim 10, wherein two adjacent hydroquinone subunits alternate with one benzoquinone subunit.

14. A polymer of claim 10, wherein two adjacent benzoquinone subunits alternate with one hydroquinone subunit.

15. A block copolymer having the formula:



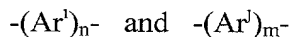
wherein

each  $R^{21}$  and  $R^{22}$  is independently selected from the group consisting of H, substituted or unsubstituted  $(C_1-C_{12})$ alkyl, substituted or unsubstituted  $(C_1-C_{12})$ alkoxy, substituted or unsubstituted  $(C_1-C_{12})$ alkylamino, substituted or unsubstituted  $(C_1-C_{12})$ alkylthio, substituted or unsubstituted di $(C_1-C_{12})$ alkylamino, substituted or unsubstituted arylamino, substituted or unsubstituted diarylamino and halogen;

the subscript k is an integer of from 2 to 20;

the superscript j is an integer of from 1 to k and indicates the position downstream from  $R^{21}$  of each Q;

each  $Q^j$  is a para-phenylene block subunit or a solubility-enhancing subunit, said subunits selected from the formulae:



wherein

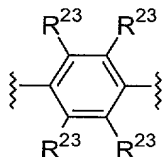
the subscript n is an integer of from 5 to 15;

the subscript m is an integer of from 1 to 5;

each  $Ar^l$  is a substituted or unsubstituted aryl group linked in a manner that maintains a coplanar orientation relative to adjacent  $Ar^l$  groups;

each  $Ar^l$  is selected from the group consisting of

a) a 1,4-phenylene group having the formula:



wherein each  $R^{23}$  is a member independently selected from the group consisting of

H, substituted or unsubstituted  $(C_1-C_{12})$ alkyl, substituted or unsubstituted  $(C_1-C_{12})$ alkoxy, substituted or unsubstituted  $(C_1-C_{12})$ alkylamino, substituted or unsubstituted  $(C_1-C_{12})$ alkylthio, substituted or unsubstituted di $(C_1-C_{12})$ alkylamino, substituted or unsubstituted arylamino, substituted or

unsubstituted diarylamino and halogen, with the proviso that at least two of the four R<sup>23</sup> substituents are independently selected from substituted or unsubstituted (C<sub>1</sub>-C<sub>12</sub>)alkyl and substituted or unsubstituted (C<sub>1</sub>-C<sub>12</sub>)alkoxy, and

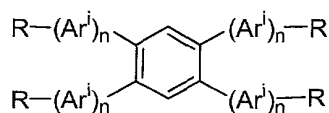
b) an aryl biradical selected from the group consisting of 1,4-naphthylene, 1,4-anthrylene, 9,10-anthrylene, 5,6,7,8-tetrahydronaphth-1,4-ylene, 9,9',10,10'-tetra(C<sub>1</sub>-C<sub>12</sub>)alkyl-9,10-dihydroanthr-1,4-ylene, 9,9'10,10'-tetraaryl-9,10-dihydroanthr-1,4-ylene, 9,9'10,10'-tetra(C<sub>1</sub>-C<sub>12</sub>)alkyl-9,10-dihydroanthr-2,6-ylene, 9,9'10,10'-tetraaryl-9,10-dihydroanthr-1,4-ylene.

**16.** A block copolymer of claim **15**, wherein Q<sup>1</sup>, Q<sup>3</sup> and Q<sup>5</sup> are block para-phenylene subunits and Q<sup>2</sup>, Q<sup>4</sup> and Q<sup>6</sup> are solubility enhancing subunits.

**17.** A block copolymer of claim **15**, wherein Q<sup>1</sup>, Q<sup>3</sup>, Q<sup>5</sup> and Q<sup>7</sup> are solubility enhancing subunits and Q<sup>2</sup>, Q<sup>4</sup> and Q<sup>6</sup> are block para-phenylene subunits.

**18.** A block copolymer of claim **15**, wherein each Ar<sup>i</sup> is selected from the group consisting of unsubstituted 1,4-phenylene and fluoro-substituted 1,4-phenylene .

**19.** A branched polymeric aromatic compound having the formula:



wherein

each R is a member selected from the group consisting of substituted or unsubstituted (C<sub>1</sub>-C<sub>12</sub>)alkyl, substituted or unsubstituted (C<sub>1</sub>-C<sub>12</sub>)alkoxy, phenyl and halogen;

the subscript n is an integer of from 3 to 8;

Ar is a substituted or unsubstituted aryl group and i is an integer denoting its position away from the central tetrasubstituted phenyl ring, and each Ar<sup>i</sup> can be the same or different from Ar<sup>j</sup> at any other position;

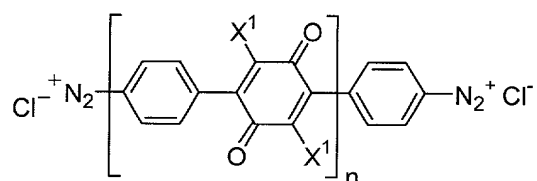
with the provisos that the Ar<sup>i</sup> groups are linked together in a 1,4-paraphenylene manner.

1                   20.     A branched polymeric aromatic compound of claim 19, wherein the  
2     subscript n is 3; each Ar<sup>1</sup> and each Ar<sup>3</sup> is 1,4-phenylene; and each Ar<sup>2</sup> is a substituted or  
3     unsubstituted 1,4-phenylene.

1                   21.     A method of preparing a polymeric OLED material on a solid support,  
2     said method comprising:

3                   (a) contacting a solid support-bound aryl diazonium salt with 3,6-  
4     dichloroquinone under conditions sufficient to form a solid support-bound aryl quinone  
5     derivative; and

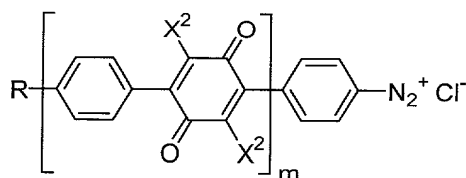
6                   (b) contacting said solid support-bound aryl quinone derivative with a  
7     diazonium compound having the formula:



8  
9     wherein each X<sup>1</sup> is a blocking group and the subscript n is an integer of from 0 to 4;  
10     under conditions sufficient to form an intermediate poly OLED material;

11     (c) repeating steps (a) and (b) from 2 to 70 times; and

12     (d) terminating the polymeric OLED material by contacting the product of  
13     step (c) with a terminating diazonium compound having the formula:



14     wherein

15     each X<sup>2</sup> is a blocking group,

16     R is a member selected from the group consisting of H, substituted or unsubstituted

17     (C<sub>1</sub>-C<sub>12</sub>)alkyl, substituted or unsubstituted (C<sub>1</sub>-C<sub>12</sub>)alkoxy, substituted or

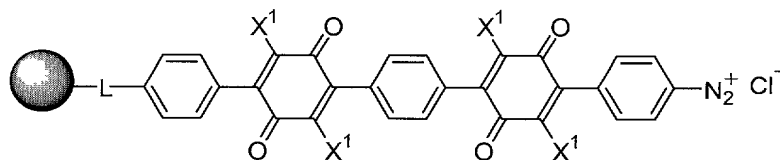
18     unsubstituted (C<sub>1</sub>-C<sub>12</sub>)alkylamino, substituted or unsubstituted (C<sub>1</sub>-

19     C<sub>12</sub>)alkylthio, substituted or unsubstituted di(C<sub>1</sub>-C<sub>12</sub>)alkylamino, substituted or

20     unsubstituted arylamino and substituted or unsubstituted diarylamino; and

21     m is an integer of from 0 to 3.  
22

22. A method in accordance with claim 21, wherein an intermediate poly OLED material is produced having the formula:



wherein

L is a linking group;

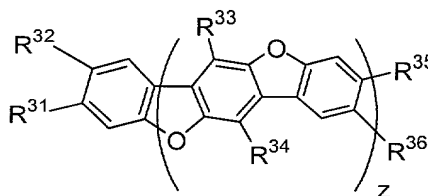
the shaded sphere is a solid support; and

X<sup>1</sup> is a member selected from the group consisting of halogen, substituted or unsubstituted alkyl, substituted or unsubstituted alkoxy, substituted or unsubstituted alkylamino, substituted or unsubstituted alkylthio, and substituted or unsubstituted dialkylamino.

23. A method in accordance with claim 21, wherein said solid support is selected from the group consisting of glass, tin oxide, indium oxide, and mixtures thereof.

24. A solid support-bound poly OLED material formed by the method of claim 21.

25. A polyfurano ladder oligomer having the formula:



wherein

the subscript z is an integer of from 2 to 7;

each of R<sup>31</sup>, R<sup>32</sup>, R<sup>33</sup>, R<sup>34</sup>, R<sup>35</sup>, R<sup>36</sup> is independently selected from the group consisting of H, substituted or unsubstituted (C<sub>1</sub>-C<sub>12</sub>)alkyl, substituted or unsubstituted (C<sub>1</sub>-C<sub>12</sub>)alkoxy and halogen.

26. A polyfurano ladder oligomer of claim 25, wherein R<sup>32</sup> and R<sup>35</sup> are each H.

1                   **27.**     A polyfurano ladder oligomer of claim **25**, wherein z is an integer of  
2     from 2 to 4; and R<sup>32</sup> and R<sup>35</sup> are each H.

1                   **28.**     A method of forming a light emitting polymer, said method comprising  
2     exposing an oligomeric para-phenylene compound of claim 1 having attached acrylate ester  
3     groups to sufficient ultraviolet light to form a light emitting polymer comprising a plurality of  
4     said oligomeric para-phenylene compound covalently attached to each other via ester and  
5     ether linkages.

1                   **29.**     A method of forming a light emitting polymer, said method comprising  
2     exposing a polyfurano ladder oligomer of claim **25** having attached acrylate ester groups to  
3     sufficient ultraviolet light to form a light emitting polymer comprising a plurality of said  
4     polyfurano ladder oligomers covalently attached to each other via ester and ether linkages